DOCUMENT RESUME

ED 335 328 TP 033 217

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TITLE Looking in Mirrors: Teachers Doing, Seeing, Knowing.
PUB DATE Apr 91
NOTE 28p.; Paper presented at the Annual Meeting of the American Educational Research Association (Chicago, IL, April 3-7, 1991).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Concept Formation; Elementary Education; Elementary School Teachers; *Feedback; Heterogeneous Grouping; *Instructional Innovation; *Supervisory Methods; *Teacher Behavior; *Teacher Effectiveness; Teacher Supervision; Teaching Methods; Teaching Models
IDENTIFIERS *Knowledge Base for Teaching

ABSTRACT

In this study, relationships were examined among three aspects of the implementation of complex instruction, an innovative approach to teaching in heterogeneous classrooms. These three aspects were: (1) teachers' use of the complex instruction strategies in the classroom; (2) systematic and comprehensive feedback received by teachers from the developers of the innovation; and (3) teachers' conceptual understanding of the theoretical and empirical knowledge base underlying complex instruction. For this study, data collected as part of a larger project conducted by the Stanford University School of Education were used. Thirteen teachers in 5 elementary schools constituted the sample; data sources were a minimum of 20 classroom observations of each teacher, questionnaires, structured and open-ended interviews, and records of collaborative meetings between teachers and supportive supervisors. The findings indicated that the frequency of feedback sessions was positively and significantly related to the quality of the implementation of the innovation, and the teacher's conceptual understanding of the knowledge base. Teachers' conceptual understanding was positively and significantly related to the more sophisticated teaching strategies but showed no relationship to the more routine behaviors. Case studies illustrate the quantitative findings. Theoretical and practical implications of the findings are discussed. (Author/AMH)

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Looking in Mirrors: Teachers Doing, Seeing, Knowing

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Paper presented at the Annual Meeting of the
American Educational Research Association
April, 1991
Chicago, Illinois

Running head: LOOKING IN MIRRORS
**Authors' names are in alphabetical order.*

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Abstract

In this study, we examined the relationships between three aspects of the implementation of Complex Instruction, an innovative approach to teaching in heterogeneous classrooms. These three aspects were: 1) teachers' use of the strategies in the classroom, 2) systematic and comprehensive feedback received by teachers from developers of the innovation, and 3) teachers' conceptual understanding of the theoretical and empirical knowledge base underlying Complex Instruction.

We found that the frequency of feedback sessions was positively and significantly related to 1) the quality of the implementation of the innovation, and 2) to the teacher's conceptual understanding of the knowledge base. Teachers' conceptual understanding was positively and significantly related to the most sophisticated teaching strategies but showed no relationship to the more routine behaviors. We also used case studies to illustrate our quantitative findings.

Theoretical and practical implications of our findings are discussed.

Looking in Mirrors: Teachers Doing, Seeing, Knowing

How do teachers make changes during the implementation of an instructional innovation? The following comments are from teachers during their first year of implementation of complex instruction, an innovative instructional program developed at Stanford University:

> First teacher: All the pieces of the puzzle don't make sense at first. But afterwards when you go out and implement it, it makes sense.
>
> Second teacher: Feedback is important so you know whether you are doing what the program is asking you to do and whether children are reaping the benefit. And (you are reminded of) some things you could do to better implement it.
>
> Third teacher: Now (at the end of the first year of implementation) my students have gotten so accustomed to helping one another, they have trouble not doing it.

Purpose

Do teachers adopt new instructional approaches automatically on command, do they copy models, or do they translate and adapt theory to fit their own needs? Some developers of innovations attempt to produce routine "teacher-proof" materials and textbooks that dictate teachers' actions and bypass their decision-making and thought processes. Other innovators believe that teachers make sense out of an incredible diversity of information sources, including knowledge about the theoretical bases and instructional processes recommended for implementation of the innovation, theoretical and empirical literature relevant to the innovation, information about individual students, and teachers' self knowledge about their own interactions with students (Shulman, 1974).

In this study we examine relationships between three aspects of the implementation of a complex instructional innovation: (1) teachers' use of the strategies in the classroom, (2) systematic and comprehensive feedback received by teachers from developers of the innovation, and (3) teachers' conceptual understanding of the theoretical and empirical knowledge base underlying the

innovation. In part, we concur with Joyce & Clift (1984), that:

> ... helping teachers use any complex pattern of behavior requires instruction in the theory of the behavior, modeling, opportunities to practice the behavior, and extensive coaching as teachers work with the behavior in their own classrooms. Teachers need a supportive environment in which they are free to make mistakes and receive ample, non-threatening opportunities for corrective feedback.

Joyce and Clift offer a framework synthesized from information, observation about the current states of schools and teachers, and value positions. They argue that a major task in any reform effort is to generate testable approaches to the substance and process of teacher education and to wed reform with research. The present study is a response to their summons and others that are similar. We extend Joyce and Clift's notion of the "coaching" of teachers as the attempt is made to change their teaching strategies. We make the prediction that teachers who clearly understand the conceptual underpinnings of a complex innovation will learn to implement that innovation better than teachers who do not have a firm grasp of the theories. We collected data to test our prediction.

The present study makes three main contributions to research on the implementation of educational reforms. The first contribution is the use of comprehensive, systematic feedback to teachers on their classroom implementation (Dornbusch & Scott, 1975). Especially important was our insistence on feedback that was soundly based. Soundly based feedback goes beyond behavioristic models of coaching that focus on the teacher's behavior without relating behavior to the theoretical foundations of the innovation. Moreover, soundly based feedback is grounded on systematic observations of teachers' practice in classrooms. The specificity of feedback resembles a mirror held up to teachers to view their own practice. Indeed, for selected teachers, the regular feedback was enhanced by video tapes of teachers (Benton, in progress).[1]

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[1]Benton, J. (forthcoming). Treating status problems in the classroom: Training teachers to assign competence to students exhibiting low status behavior in the classroom. Stanford University, Stanford, CA: Dissertation in progress.

Supervisors assisted teachers in the analysis of video tapes. They helped teachers focus on specific events that were difficult for

The criteria for feedback and standards for implementation were clear in the present study. Teachers knew which behaviors encouraged children to talk and work together, which in turn are the behaviors that produce students' learning. Standards for implementation were based on previous research that documented the relationships between the essential features of the program and student achievement.

Feedback was delivered by program developers in non-evaluative, collaborative contexts. Teachers' performance was neither a basis for merit pay nor any other organizational reward. Ellis (1987) conceptualized this kind of feedback by program developers as supportive supervision; feedback given at regular intervals and well structured to focus on teachers' performance of non-routine teaching behaviors that were designed to increase students' learning gains. For each feedback session, supportive supervisors used graphs based on at least three classroom observations. On the graphs teachers saw visual representations of the proportion of their desirable to undesirable teaching behaviors.

A second contribution of the present study is the focus on teachers' knowledge of how to implement the innovative program, as well as why. We argue that teachers are professional decision-makers who reflect on the theoretical as well as the empirical features of an innovation.

A third contribution of this study is the examination and monitoring of implementation over time, repeatedly, in the same classrooms, taking into account the possibility that teachers may be cognizant of the theoretical foundations of

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teachers to respond to in the ongoing life of the classroom. For example, when low status students displayed competence for a variety of abilities, teachers tried to make those abilities public in the classroom by making specific remarks about them. Video tapes of students who displayed special abilities offered teachers opportunities to practice appropriate responses and gave them models for identifying such opportunities. Without such practice and specific analysis, teachers tended to stereotype low status students as not committed or lazy. It was difficult for teachers to identify students' multiple abilities related to the learning task at hand and offer public and specific praise. The innovative program required teachers to analyze events quickly, understand what the task called for, and make known what the student could do.

teaching practice in addition to their focus on classroom action. This perspective departs from that of Shavelson (1988), who suggests that teachers may focus mainly on classroom action and that research benefits the practice of teaching only when it improves practical arguments in the minds of teachers. Indeed, many programs are not based on a theoretical framework or empirical data. However, when a theoretical and empirical knowledge base exists, we expect a different situation. Lotan (1985) found significant positive links between teachers' conceptual understanding and quality of implementation in her empirical study of a complex innovation that contained a clear theoretical knowledge base supported by empirical evidence.

Theoretical Framework

Organizational theorists tell us that the more complex the worker's task becomes, the more advantageous it will be to use lateral, rather than top-down, channels of communication (Perrow, 1967). The use of lateral communication channels helps workers by increasing opportunities for them to use each other as information resources. When teachers use a complex instructional technology involving many non-routine features, they experience higher levels of uncertainty than they would within more routine technologies. Organizational sociologists theorize that lateral communication affords workers opportunities to obtain and process information and to gain assistance, thereby lowering their uncertainty and increasing their productivity (Galbraith, 1973). If the theory holds for teachers using a complex instructional technology, then those teachers who talk about their teaching will improve their classroom performance as they gain more knowledge and eliminate uncertainty by collaborating.

March and Simon (1958) argue that in less routine task environments, individuals engage in wider and higher-level search procedures than in more routine task environments. Wider search procedures are undertaken when individuals search for information from those in lateral positions, rather than above them in organizational hierarchies. Higher-level searches occur when individuals ask experts for information. In the present study, where the task environment of teachers was largely non-routine, supportive supervisors provided an important arena for collaboration in the feedback sessions with teachers. Supportive supervisors observed teachers and gave them specific, systematic feedback on their implementation of complex instruction. The supportive supervisors were not linked

with administrative evaluators in the school organizational hierarchies. However, they were experts on the implementation of complex instruction, and they were able to provide teachers with crucial information. Teachers were able to inquire freely and exchange information with supportive supervisors.

Although previous researchers have examined lateral communication (Rosenholz, 1989; Little, 1982), few have examined what is being discussed. In the present study the content of feedback sessions was known to be specific to implementation of the innovation because topics were closely monitored. The feedback sessions were designed so as to be closely aligned with the instructional technology.

Ellis (1987, 1990) found that, under certain conditions, this collaboration was associated with teachers' use of non-routine teaching strategies (and non-use of routine strategies) when they used a complex instructional technology designed to encourage students to talk and work together. The first hypothesis is:

> Given a complex innovation, supportive supervision and quality of implementation will be positively related.

The remaining question for this study is; What is the relationship of teachers' collaboration (with the supportive supervisor) to teachers' understanding and implementation? Following Scott (1981), Lotan (1985) argues that the facets of classroom technology are materials, operations, and knowledge. Practitioners use two kinds of knowledge: (1) highly codified, regulated, and explicit knowledge and (2) complex, abstract knowledge typically used for problem solving. Although abstract knowledge is not situation-specific, this body of knowledge is organized and structured so as to permit systematic application of its concepts and principles. Lotan (1985) discovered that teachers' conceptual understanding of a complex instructional technology was positively associated with their implementation of non-routine teaching strategies in a complex instructional technology. Replicating Lotan's study in this different sample of teachers, we hypothesize that:

> Given a complex innovation, teachers' understanding of the underlying body of knowledge will be positively related to teachers' classroom performance.

Understanding develops from three different experiences: (1) the workshop,

(2) a practicum experience during the workshop and implementation in the classroom, and (3) sound feedback that makes connections between theory and implementation. Thus, the third hypothesis is:

> Given a complex innovation, feedback by supportive supervisors will be positively related to teachers' conceptual understanding of the theoretical knowledge base.

The theoretical model is neither linear nor causal, but interactive. Therefore, we will examine the various relationships one by one rather than in a simultaneous linear mode. Figure 1. is a visual representation of the model.

----------Figure 1 about here----------

Methodology

Setting and Sample

For purposes of this study, we used data collected as part of a larger project conducted under auspices of the Program for Complex Instruction at the Stanford University School of Education. Thirteen teachers in five elementary schools constituted the sample. The complex instructional approach was used in conjunction with Finding Out/Descubrimiento, an English/Spanish math and science curriculum for elementary schools. (For a detailed description see Cohen, 1986, and Cohen and Lotan, 1989). Data sources were a minimum of 20 classroom observations of each teacher, teacher questionnaires, structured and open-ended interviews, and records of collaborative meetings between teachers and supportive supervisors (Stanford staff). Final interviews were designed to reveal teachers' conceptual clarity and understanding of the theory, as well as the basic principles and features of the program.

The classrooms in this study had the following characteristics (adapted from Lotan, 1990):

1. students were from racially, ethnically, linguistically, and socially mixed

backgrounds,

2. materials (which include manipulatives) and activities used by these students were diverse and differentiated,

3. task activities were such that multiple intellectual abilities were needed for successful completion, providing opportunities for all students to contribute and to serve as intellectual resources,

4. to stimulate peer interaction, tasks were uncertain from the students' point of view, open-ended, and intrinsically interesting,

5. to maximize student participation and peer interaction, instruction was conducted in heterogeneous small groups, with emphasis on group norms and student roles as well as individual accountability,

6. groups were differentiated, with each group working on a different activity with different materials,

7. teachers implemented an instructional approach that emphasizes non-routine teaching behaviors such as delegating authority to students, thus making them responsible for their own and their group mates' task engagement and learning;

8. to equalize and balance interaction in the heterogeneous groups, teachers used strategies designed to counteract unwanted domination of the group by its high-status members;

9. complex instruction, the classroom technology, is grounded in a well defined and clearly stated, theoretical and empirical body of professional knowledge,

10. teachers participated in extensive and thorough theoretical as well as practical training and received feedback on their performances in the classroom during the school year.

In Complex Instruction, the lesson is usually divided into three parts: 1) a

brief orientation to the activities by the teacher, 2) the learning center time during which students work in small groups ont he day's tasks, and 3) a wrap-up during which reporters from each group report to the teacher and to the whole class about the result of their work in the groups. Given the characteristics of the tasks and the organization of the classroom, during learning center time students engage in exciting scientific activities. They read and discuss the instructions to the tasks, they hypothesize about reasons and outcomes, they perform experiments, they observe, measure, calculate, and record their findings (Lotan, 1990).

Procedures

The first hypothesis of the study states that there is a positive relationship between the amount of supportive supervision and the quality of the teacher's classroom performance as prescribed by the program developers. Supportive supervision consists of a) Systematic observations of the implementation of the program in the classroom and b) an in-depth, problem-solving analysis of these observational data during structured feedback meeting between the teacher and a supportive supervisor. In the present study, such supportive supervision was provided to the teachers by staff members of the Stanford project. Selected teachers volunteered to receive additional feedback and training by analyzing videos of their students' and their own performances in the classroom.

The amount of supportive supervision is indicated by the frequency of feedback meetings between the teacher and a Stanford trainer/staff developer. Although the model of staff development for complex instruction prescribes at least three such meetings during the academic year, at the time of data collection for this study (the 1984-85 academic year), there was considerable variation in the number of these meetings among the teachers in the sample. This variation came about for a number of reasons: a) Stanford was conducting an experiment in which four out of thirteen teachers received video feedback focusing on specific non-routine behaviors (status treatments) in addition to the regular feedback; b) at first, many teachers felt threatened by having classroom data presented to them and perceived the feedback as an evaluation. As a result, some teachers successfully avoided setting up meetings with the staff, and sometimes even cancelled meetings already planned; c) serious shortages of staff members on the Stanford project made them less persistent and consistent in pursuing the teachers and bugging them to set up meetings. Thus, one teacher received no feedback before the end of the

observations, six teachers participated in two sessions, three teachers in three and one teacher participated in four feedback meetings. These numbers include regular as well as video feedbacks. Measures of frequency of supportive supervision were taken from the records kept by the Stanford staff and were substantiated in debriefing interviews of the teachers.

We categorized teachers' classroom performances in two ways according to the prescriptions of the program and as derived from the theoretical and empirical knowledge base: the non-routine behaviors and those behaviors that indicate direct supervision by the teacher. In simple terms, the former are the desirable behaviors and the latter are the behaviors to be minimized, particularly at learning center time. Given the basic differences in the context of instruction during orientation and wrap/up and at learning center time, i.e. whole class vs. small group instruction respectively, date were collected separately for these two kinds of situation.

Non-routine behaviors are those teaching acts in which the teacher engages when she or he has the option to choose from a repertoire of essentially varied behaviors. Non-routine behaviors in teaching are, therefore, the result of a decision-making process that Shavelson (1973) has called the basic teaching skill. In complex instruction, the common and familiar repertoire of teacher behavior has been expanded: new strategies are introduced to the teacher who implements the program in the specific setting of small group instruction when the overall organization and social system of the classroom is changed from the traditional, whole-class setting.

Based upon theoretical formulations and empirical findings, the program developers at Stanford have defined the criteria for superior classroom performance during implementation of complex instruction. For example, a crucial feature of complex instruction is treatment of status problems in the small groups. When the teachers talk about multiple abilities and assign competence to low status students, they reduce the severity of status problems in their classrooms, thereby equalizing rates of participation of low and high status group members.

In the context of complex instruction, non-routine teaching behaviors include giving specific feedback to individuals and groups, stimulating and extending students' thinking, and treating status problems. They are non-routine because no

specific program (as defined by March and Simon, 1958) or pre-planned response can be provided to the teachers. Given the fluidity of the situation and the considerable repertoire of potentially appropriate responses, teachers have to search their minds and make decisions as to which behavior to use, given particular situations. For example, after observing the operations of the students at a particular learning center, the teacher might decide to extend learning by providing additional examples; he or she might decide to address the group as a whole or to provide feedback to an individual. Finally, the teacher might decide to move on to the next center without saying anything at all. Thus, teachers' use of non-routine teaching behaviors was measured by the following indicators, all of which are positive: 1) rate of teacher's talk about multiple student abilities; 2) rate of giving specific feedback to students;
3) rate of teachers's talk about extending activities; 4) rate of teacher's talk about student thinking.

In contrast to the non-routine behaviors explained above, some teaching behaviors are of more routine nature and they are also an essential part of conducting the classroom effectively. However, these routine behaviors need to be minimized in complex instruction. Research has shown that student interaction (the main predictor of learning) is short-circuited when teachers help student with the task, when they provide too much information, or when they question too often (Cohen, Lotan with Leechor, 1989). Thus, teachers' use of routine teaching behaviors was measured by the following indicators of implementation, all of which are negative: 1) rate of teacher's facilitating students' work, solving problems for students that could be solved by the students themselves; 2) rate of teacher's disciplining students; 3) rate of teacher's questioning students when the questioning is accompanied by high rates of facilitating.

Data about teachers' classroom performance were obtained from systematic observations of the teachers during implementation of complex instruction. Observers used a standardized teacher observation instrument to categorize and tally teachers' verbal interactions during ten-minute intervals. Inter-observer reliability was established at over 90% agreement with a criterion observer.

The teacher observation instrument was used to guide observations of implementation for each of the 13 teachers approximately 20 times during the school year. During an average classroom period of about 45 minutes, each

observation lasted 10 minutes while students were at learning centers and 10 minutes while the teacher was conducting an orientation or a wrap-up.

The first hypothesis of the study is translated into the following specific predictions:

1) The frequency of feedback meetings between teacher and supportive supervisor will be positively related to the average rate of non-routine teaching behaviors during a) learning center time and, b) during orientation and wrap-up.

2) The frequency of feedback meetings between teacher and supportive supervisor will be negatively related to the average rate of routine teaching behaviors during a) learning center time and, b) during orientation and wrap-up.

The second hypothesis of the study focuses on the relationship between teachers' understanding of the underlying knowledge base to complex instruction and her classroom performance. We hypothesized that when the teacher has a better grasp of the theoretical framework and the empirical findings, she will minimize the routine behaviors and will maximize the non-routine behaviors. Methodologically, the measurement of teachers' conceptual understanding of this knowledge base presented a serious challenge. We clearly could not administer a test to them. However, based upon a previous study (Lotan 1985), we were able to infer conceptual understanding from teachers' answers to certain questions in an open-ended interview. For example, we asked teachers the following questions: "Please think of the child in your classroom who is seen by his classmates as slow and who does not have many friends. How did this child function during FO/D? Do you think the program made him feel more competent? What in the program do you think could be responsible for helping a child like that? Did you make any special effort to help this child during FO/D?

The interview, administered to the teachers at the end of the academic year, had two overt and one covert purpose: it was designed so that teachers' conceptual understanding could be inferred from a) teachers' responses to questions that asked for evaluation of their training and from b) their responses to situations that presented them as potential disseminators of information about complex instruction.

The context of the verbal information expressed by the teachers during the interview was evaluated, scored and quantified by comparing it to standards derived from the theoretical formulation by the developers. Conceptual understanding of the following aspect of complex instruction were evaluated: 1) goals and scope of the program; 2)principles of cognitive learning; 3) classroom management in small-group instruction; 4) treatment of status problems; 5) the importance of organizational support for complex instruction. (Guidelines and additional details for scoring are described in Lotan, 1985).

Two independent scorers interpreted and coded the content of the interviews. Inter-scorer reliability was 86% agreement. The scorers were careful to differentiate between a) verbal information and cues from which conceptual understanding of an item (key concept or principle) could be inferred and b) reports about behavioral manifestations of a particular item. After coding the interview, the scorer arrived at a count of the total number of times a particular item was mentioned as well as the total number of items to which references were made in the interview. For the measure of overall teacher understanding, we simply added the total number of items coded in the interview.

The second hypothesis is translated into the following predictions:

3) Teachers' overall understanding of the knowledge base of complex instruction will be positively related to the rate of non-routine teaching behaviors a) during learning centers, and b) at orientation and wrap-up.

4) Teachers' overall understanding of the knowledge base of complex instruction will be negatively related to the rate of routine teaching behaviors a) during learning centers, and b) at orientation and wrap-up.

The third hypothesis deals with the relationship between the frequency of feedback meetings and the teachers' overall conceptual understanding. The following prediction is derived from the third hypothesis.

5) The frequency of feedback meetings between the teacher and the supportive supervisors will be positively related to the teacher's overall understanding of the program.

Results

Table 1 shows the descriptive statistics of the variables in the study. The mean value of the variable of teachers' overall conceptual understanding was 94.82 and the standard deviation for that variable was 26.68. There was a considerable range in this variable as indicated by the minimum and maximum values. The statistics of the next variable, frequency of feedbacks, ($x=1.77$; $sd=1.17$) reflects the variation in the number of feedback meetings for the teachers in the sample.

----------Table 1 about here----------

Table 1 also shows the average rate per 10 minutes of observation period of selected teaching behaviors. Among these behaviors, the highest average rate was for direct supervision at learning centers ($x=21.2$, $sd=12.46$). The lowest average rate was for non-routine behaviors during orientation and wrap-up ($x=6.49$; $sd=3.51$). In general, the average rates of non-routine behaviors were lower than those classified as supervisory.

----------Table 2 about here----------

Table 2 shows the strength of relationships among variables of the study. All the relationships between the frequency of feedback and the teaching behaviors were in the direction predicted and statistically significant. Frequency of feedback and direct supervision at learning centers and during orientation and wrap-up were both significantly negatively related: $r=-0.53$, $p<.05$ and $r=-0.65$, $p<.01$ respectively. Frequency of feedback and non-routine behaviors at learning center and during orientation and wrap-up were both significantly positively related: $r=.57$, $p<.05$ and $r=.68$, $p<.01$ respectively.

The relationship between teachers' overall understanding and teaching behaviors were in the predicted direction. However, only the relationship between overall understanding and non-routine behaviors at learning centers achieved statistical significance, $r=.55$, $p<.05$.

There was also a statistically significant positive relationship between the frequency of feedbacks and teachers' overall understanding ($r=.62$, $p<.05$), meaning that those teachers who participated in more feedback meetings also had

a better understanding of the underlying knowledge base of the program.

Discussion

The data were supportive of the predictions that had to do with the relationships between feedback and the teachers' classroom performance, on the one hand, and between feedback and the teachers' conceptual understanding on the other. The results of data analysis relating to predictions about the relationship between teachers' conceptual understanding and their classroom performance were mixed.

When classroom technology is complex, it is uncertain and requires constant non-routine problem solving by the teacher. Supportive supervision then becomes necessary to promote and maintain quality implementation. Both the technology and the content of the supportive supervision described in this study were quite different from the average instructional innovation or the "coaching" that seem to be wide-spread nowadays. As presented in this study, the feedback to the teachers was highly structured, task-oriented and performance-specific. The innovation was complex and the teachers' behaviors highly non-routine according to the dimensions defined by the program. It could well be the case that other, less complex and less deep-reaching educational innovations do not need such an elaborate support system in order to be well implemented and in order to survive.

Teachers' conceptual understanding of the underlying body of knowledge seems particularly relevant to the implementation of non-routine behaviors during learning center time. It is at this time that decision-making is most challenging because the teacher needs to "think on her feet." On the contrary, orientations and wrap-ups are more easily planned and thought out ahead of time. We speculate that more routine strategies, which can be planned ahead for orientations and wrap-ups, can be employed by teachers without so great an overall understanding of the theoretical bases of the program.

Of particular importance is the existence of a well-defined and immediately relevant body of knowledge that underlies this complex technology. Unlike many, if not most educational innovations, complex instruction has a solid theoretical basis that is supported by educational research. It includes definitions of social science concepts as well as predictions and explanations of relationships among

these concepts in classroom settings. The body of knowledge posits general pedagogical rules and principles and the conditions for their applications.

Examples from the case studies.

Next, we return to the teachers' interviews to find out what they said about the feedback they received from supportive supervisors. Mrs. Putney best exemplifies the predicted results. She was observed and received feedback in four formal sessions. Her implementation in the classroom was exemplary. She had the highest ranking scores on non-routine teaching behaviors and overall understanding of the program. She ranked lowest and second lowest, respectively, on routine teaching behaviors at orientations and wrap-ups. She said:

> I wouldn't have minded if the feedback sessions had been more frequent and earlier in the year. They were extremely useful because they were so specific. I got a very clear picture of what was going on. I now have a much more clear idea of what it is that I said at the beginning of the year and how I've changed. In the beginning a comment like "Rosa has done thus, thus, thus..." would never have struck me as a comment that would fit anywhere. I would never have recognized it as specific feedback. I can see the same principles apply with us (teachers) and the children. That is, the more specific feedback you get, the better you understand.

Mrs. Putney saw that the process of her own learning to implement the program was analogous to processes of students' learning. The same principles applied. The more specific she was in her comments to individual children, the more they learned. In turn, the more specific the feedback she received from her supportive supervisor, the more she learned about teaching in the group work setting. She gave evidence that she was able to view her own learning objectively.

Consistent with the predictions of the present study but at the other end of the scale, Mrs. Valenza's story was not a tale of success. She participated in only one feedback session, her overall understanding of the program was low, and her performance of routine teaching behaviors at learning centers was higher than any other teacher's. For routine teaching behaviors at learning centers, Mrs. Valenza's mean score was 44.3; the sample mean was 21.2. At the end of the year her comments on the feedback were as follows:

> Jane (Mrs. Valenza's supportive supervisor) said I was supervising kids a lot. After our first (feedback) session I tried not to do that a lot. It was very helpful. Jane understood that one student needed more help from the teacher than the other students. The time I spent directly supervising them was well spent time. Once Jane showed me the percentage graphs (of my teaching behaviors), she understood why I had to supervise so much. Especially since I have a second grade. After Jane understood the conditions, I don't think there were any problems. I know she wanted me to do more. She suggested a couple of things, like: let the aide do more questioning, stand back nd watch kids in their roles, give specific feedback. I think I'll use those suggestions next year.

Mrs. Valenza directly resisted acting on the feedback based on graphs of her teaching behaviors. Jane tried to show her that she was giving students too much help and supervising too directly. Mrs. Valenza had ready excuses for refusing to take suggestions and ingratiated herself by resolving to Jane's suggestions next year. Blaming the grade level she taught and a student who needed extra help, she failed to recognize principles that applied to her own learning processes. Observers in Mrs. Valenza's classroom noted that she frequently apologized because she her second graders didn't "get" the science concepts they explored, even when she gave explicit help and instruction. She didn't seem to understand that one of the goals of the program was to encourage children to ask questions, observe, and discover independently.

Mrs. Putney and Mrs. Valenza were exemplars of the predictions made in the present study and the findings. Feedback and implementation were strongly associated. Overall understanding of the program was closely associated with feedback and non-routine teaching strategies at learning centers. At orientation and wrap-up, non-routine strategies and overall understanding were associated, but the correlation did not reach a level of significance at $p < .05$.

Next we will describe Miss Escher and Mrs. Rickover, two teachers who resembled the results of the present study more closely than Mrs. Putney and Mrs. Valenza. Miss Escher participated in three feedback sessions, two of the sessions based on videotapes of her teaching. Classroom observations disclosed her as a highly skilled teacher who used many of the program's recommendations frequently. She ranked second highest in the use of non-routine teaching

behaviors. Surprisingly, she had the lowest score on overall understanding of the program. Her comments on the feedback seem to reveal an emphasis on negative information. For example, she said:

> Many times I got caught up with facilitating (helping too much). It was helpful for (a colleague) to observe me to remind me to stay in my role. I think the purpose of the feedback is to help us to be aware of our mistakes and help us improve on them and to help us know what we're doing right. What was useful? Pointing out the positive things and negative things. Seeing things I wasn't even aware of. Everybody hates to know they're doing something wrong or negative. In the long run it was good. Once in a while when I had a good day, no one was there.

Miss Escher complained that Felicity, her classroom aide, liked to "hover" over students while they worked. She said she had "tried to talk to Felicity, but she's established in her ways." Although Miss Escher was self-critical and mentioned habits she tried to eliminate, such as trying not to facilitate, hover, or help students too much; her observed classroom behavior was quite positive. She asked children stimulating questions, extended activities, talked to children about multiple abilities and thinking processes. In the context of trying to model teaching behaviors for her aide to adopt, she may have been able to "step outside" her own perspective and see herself objectively. Although she had a poor understanding of the program itself, the feedback sessions may have given her enough information and visual imagery to enable her to act in a recommended way without being well grounded in the theory.

Ms. Rickover participated in only one feedback session. Following the original predictions in the present study, she had high scores on routine teaching behaviors, especially at learning centers. Contrary to predictions in this study, her score on overall understanding of the innovative program was fourth from the highest. She said she "felt frustrated because there was always something I didn't do." Like Miss Escher, Ms. Rickover expressed some dismay over conflicts with her classroom aide and a lack of time for communication. She said:

> I never had any planning time with my aide. She had a hard time knowing when to discipline and how to discipline. And so she didn't know when it was hovering and when it was disciplining. She had a hard time. Toward

> the end (of the year) I would lose my patience a little bit and I felt bad because we (the aide and I) never got to stand and talk, but I just told her - look, you handle it. Don't come over and ask me. You can handle it.

On the subject of feedback, Ms. Rickover said it was useful because it gave her positive reinforcement and because it made her aware of opportunities she had missed to talk about such things as multiple abilities. Although Ms. Rickover understood the program well, her failure in classroom implementation was compounded by her failure to model the recommended teaching behaviors for her assistant. She had not succeeded in "stepping out of herself" to look at herself as a teacher, as an instructor for her aide, or as a teacher-learner. Instead, she was caught in feelings of frustration, complaining that there was "always something I didn't do." Ms. Rickover did excessive amounts of questioning and "hovering."

What can we learn from the individual cases? Considered as a pair who were alike in successful implementation and receiving greater amounts of feedback, Mrs. Putney and Miss Escher were both enthusiastic. Their interviews had a tone of jumping on the program bandwagon. Mrs. Putney was a teacher-leader, observing other teachers and giving them feedback, working with her aide to develop teaching skills, and writing grant proposals to pay for science lab materials. Miss Escher was a follower. She was attentive to the behavior of another teacher she admired and whose implementation of the program was excellent. Like Mrs. Putney, Miss Escher was enthusiastic, but unlike Mrs. Putney, perhaps she relied more on observation and copying models than on understanding of the program for successful implementation.

Mrs. Putney looked at her own learning process objectively, as a teacher learning a new program. She understood that some of the principles of learning that apply to young children might also apply to teachers. She talked about specific feedback helping children, as well as teachers. Understanding the theoretical basis for the program helped her apply her knowledge to practice. For Miss Escher, application was a matter of mirroring images. Objective knowledge of herself as a learner was not necessary for her success in implementation of the innovation.

What, then, can we make of Ms. Rickover's high overall understanding and failure in implementation? She did not attempt to model recommended behaviors for her assistant, she was not a "teacher leader" or and enthusiastic bandwagon-

rider, and she did not have an objective view of her own learning processes. What was the source of her high level of program understanding? We can only surmise that she had ample opportunities to learn about the program, as did all the teachers in the study, and that she gleaned the information from sources other than collaborative sessions with colleagues. A footnote on Ms. Rickover's story is that she had extremely stressful problems in her personal life during the entire school year. We have no way of knowing how much those problems influenced her classroom performance.

Mrs. Valenza's low scores on all measures seem to be self explanatory, but what prevented her from gaining knowledge about the program, like Ms. Rickover? She was convinced that her students needed extra help, in spite of the program's recommendations. Was there a cultural gap, some key misunderstanding, a refusal to jump on the program bandwagon, or an inability to see herself as a teacher from an objective point of view?

Implications

Implications for researchers.

Conceptual understanding of a complex instructional program seems to be necessary for the most sophisticated aspects of implementation: non-routine teaching behaviors during learning center time. Conceptual understanding seems to be somewhat less necessary for less sophisticated aspects of the implementation: performing non-routine behaviors during orientation and wrap-ups and refraining from routine behaviors during learning centers and orientations and wrap-ups. An interesting direction for researchers would be comparisons of conceptual understanding required by teachers for implementation of more complex instructional programs and understanding required for implementation of less complex programs.

Feedback (supportive supervision) appears to be an important condition for successful implementation of all aspects of complex instruction. Surprisingly, feedback does not necessarily seem to improve implementation by increasing knowledge about the program. Feedback must have other beneficial effects. Perhaps there is a social effect: teachers may learn to take positive attitudes toward the new program, they may learn to reflect on their own learning

processes, and they may learn from concrete cases when colleagues give them specific feedback. These possibilities should be examined.

Implications for practitioners.

Organizational support for collaboration and feedback is essential for the successful implementation of sophisticated instructional programs involving non-routine teaching strategies. However, school boards and administrators will find that the expense of providing feedback, meeting teachers' needs to understand the conceptual foundations of complex instructional programs, is exorbitant and impractical in today's educational world. Complex instructional programs attempted without sufficient organizational support will have a high failure rate, even when they are hailed as valuable educational improvements.

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Figure 1
Visual Representation of the Theoretical Model

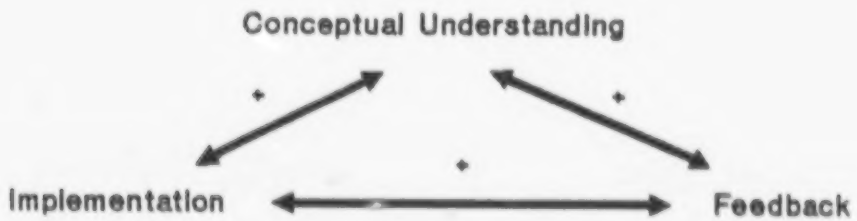

Table 1
Descriptive Statistics of Variables of the Study

VARIABLE NAME	MEAN	SD	RANGE	(N)
Over all conceptual understanding	94.82	26.68	49 - 161	(11)
Frequency of Feedbacks	1.77	1.17	0 - 4	(13)
Direct supervision learning centers	21.20	12.46	10.42 - 44.27	(13)
Direct supervision orientation/wrap-up	12.55	5.61	6.43 - 25.43	(13)
Non-routine behaviors learning centers	7.17	2.68	3.5 - 12.25	(13)
Non-routine behaviors orientation/ wrap-up	6.49	3.51	3.09 - 13.29	(13)

Table 2

Correlation Matrix of Variables of the Study

	1	2	3	4	5	6
1 Overall conceptual understanding	1.00					
2 Frequency of feedbacks	.62* (11)	1.00				
3 Direct supervision learning centers	-.36 (11)	-.53* (13)	1.00			
4 Direct supervision orientation/ wrap-up	-.20 (11)	-.65** (13)	.40 (13)	1.00		
5 Non-routine behaviors learning centers	.55* (11)	.57* (13)	-.17 (13)	-.52 (13)	1.00	
6 Non-routine behaviors orientation/ wrap-up	.43 (11)	.68** (13)	-.28 (13)	-.35 (13)	.47 (13)	1.00